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Review of the *Pediobius alcaeus* Species Group (Insecta: Hymenoptera: Eulophidae: Entedoninae) with Taxonomic Notes on Related Genera and the Description of a New Species from Japan

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The group of species allied to *Pediobius alcaeus* (Walker, 1839) [considered as the genus *Epipleurotropis* by Girault (1917)] of the genus *Pediobius* is reviewed. The group includes *P. alcaeus*, *P. termerus* (Walker, 1839), *P. coxalis* Bouček, 1965, *P. fastigatus* Kamijo, 1983, and a new species, *P. ikedai* sp. n., described from Japan (Hokkaido). *Eupleurotropis* Girault, 1917 (considered as a synonym of *Pediobius*) is synonymized with *Proacrias* Ihering, 1914, based on peculiarities of the propodeal structure, and the type species of the former genus is transferred to the latter genus [*Pr. testaceipes* (Crawford, 1914), comb. n.]. The status of the *alcaeus* species group in the genus *Pediobius* is discussed. Many new geographic records are presented, including new data on distribution of the discussed species in the Kuril Islands.

Key Words: Hymenoptera, Eulophidae, Entedoninae, *Pediobius*, *Epipleurotropis*, *Eupleurotropis*, *Proacrias*, Palaearctic region, Japan, Kuril Islands.

The genus *Pediobius* Walker, 1846 is of cosmopolitan distribution and encompasses more than 200 hitherto described species. Species of *Pediobius* have a rather broad spectrum of parasitoid-host associations: they are recorded as solitary or gregarious, primary or hyperparasitoids attacking eggs, larvae, or pupae of concealed and exposed hosts belonging to Diptera, Hymenoptera, Coleoptera, Lepidoptera, and Neuroptera, but also Mantodea, Blattodea, Hemiptera, Orthoptera, and Thysanoptera. Some species attack the egg sacs of spiders (Araneae), probably acting as secondary parasitoids (Bouček 1965; Schauff 1991).

Compared to other entedonine genera, *Pediobius* has received considerable taxonomic attention, most probably because of the economic importance of many species. Revisionary work on *Pediobius* from a wide range of regions has been undertaken, e.g., for Great Britain (Graham 1959, 1963), Europe (Bouček 1965), and the Far East in the Palearctic region (Kamijo 1977, 1978, 1979, 1983, 1986a, b; Paik 1991), the Nearctic region (Burks 1966; Peck 1985), the Neotropical region (Kerrich 1973; Bouček 1977; Hansson 2002), and also to some extent the Afrotropical and Oriental regions (Risbec 1952, 1955; Kerrich 1973; Bouček 1976). Australian species of the genus were the research subject of Burwell (1994). However, faunas of all the above regions are still not sufficiently studied and world collections contain many undescribed species, and many described ones require clarification of their status.

The main aim of this paper is to review a peculiar group of species allied to *P. alcaeus* (Walker, 1839), to discuss its placement in *Pediobius*, and to describe a new peculiar species from Japan.

Materials and Methods

Materials were borrowed from the following institutions and private collections referred to herein by the corresponding abbreviations: BMNH=The Natural History Museum, London, UK; KK=Collection of Kazuaki Kamijo, Bibai, Japan; SIZK=Schmalhausen Institute of Zoology of the Ukrainian Academy of Sciences, Kiev, Ukraine; TAMU=Texas A&M University, College Station, Texas, USA; USNM=National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA; ZMUC=Zoological Museum, University of Copenhagen, Denmark.

Scanning electron microscopy was done in the Mineralogy Department of the Natural History Museum (London, BMNH) using an ABT-55 microscope, which permits the viewing of uncoated specimens. Other illustrations were prepared using a JVC 3-CCD color videocamera KY-F55B with Auto-Montage software (version 3.02.005).

Specimens from the Kuril Islands are part of the material collected during expeditions of the International Kuril Island Project (IKIP), representing segment research of the Kuril Archipelago, initiated by the Burke Museum and the Herbarium, University of Washington; the Russian Academy of Sciences, Far East Branch; and Hokkaido University, Sapporo, Japan. This review represents the first part of an ongoing revision of the entedonine wasps of the Kuril Islands.

Systematics

Genus *Pediobius* Walker, 1846

Pediobius Walker, 1846: 184. Type species: *Entedon (Pediobius) imbreus* Walker, 1846 (designated by Ashmead 1904).

For full list of synonymies see Bouček (1965), Schauff (1991), and Hansson (2002).

Diagnosis. Frontal sulcus V-shaped, generally complete, its arms reaching inner eye margins, scrobal grooves deeply sutured, separated, or somewhat fused below point of juncture with frontal sulcus; mandibles bidentate, occasionally with row of minute teeth above upper larger teeth; ratio of number of free and fused flagellomeres in both sexes 2:3, 3:2, or 4:1 (all flagellomeres free in the last case); pronotal collar with two foveae on apical dorsal margin; lateral pronotal panel overlapped by wide propleural flange (Fig. 8, ppf); dorsellum generally large, often with two foveae (Fig. 4, drs); anterior margin of mesosternum with traced protrusion overlapping posterior margin of prepectus (Fig. 8, mtt); metapleuron generally with acute protrusion (Fig. 5, mpl); propodeum with two submedian carinae diverging posteriorly (Schauff 1991, fig. 94), subparallel, or modified into single, anteriorly raised tooth (*P. alcaeus* group, Figs 4, 5, pt); lateral propodeum with plicae (Fig. 5, pl); supracoxal flange of propodeum generally with postero-lateral protrusion.

sions in places of juncture with lateral plicae (Figs 4, 5, scp); metasomal petiole robust, often with anterior collar (Fig. 5, pet).

Distribution. Cosmopolitan (except Antarctica).

Pediobius alcaeus species group

Diagnosis. Median propodeum with raised projecting tooth (Figs 4, 5, pt) directed towards dorsellum, occasionally bearing two more-or-less visible lateral carinae or striae posteriorly; notauli complete (Fig. 6, not), deeply depressed, widened towards scutellum, and forming raised border along inner margins (also in the *crassicornis* group of *Pediobius*); spiracular elevations with projections beneath (Fig. 5, spp); dorsellum wide, triangular with distinct lateral foveae (Fig. 4, drs); gaster flattened in air-dried specimens, first gastral tergite with pair of oval membranous areas adjacent to petiolar emargination; first gastral tergum covering less than half of entire length of gaster in both sexes; all flagellomeres free in males, last two segments fused in females, except for *P. ikedai* sp. n. having all flagellar segments free in female; forewing speculum closed in all known species.

Hansson (2002) mentioned a row of small teeth above the two large mandibular teeth in *P. alcaeus*. These small teeth are present as rather minute indentations in the examined specimens of *P. alcaeus*, and are indistinct in other species of the *alcaeus* group. Further studies are needed to clarify the diagnostic potential of this character within *Pediobius*.

Biology. *Pediobius alcaeus*, the only species of its species group with a known biology, is a solitary koinobiont parasitoid of various species of *Phyllonorycter* (Lepidoptera: Gracillariidae) (Askew 1994; Askew and Shaw 1974, 1979; Shaw and Askew 1999) and some other gracillariid moths, e.g., *Cameraria corylisella* (Chambers, 1871) (Bouček and Askew 1968), *Eucestis ulmifoliella* (Hübner, 1817) (Bouček and Askew 1968; Hansson 1987). This species has also been recorded as a primary parasitoid of Tortricidae [*Archips rosana* (Linnaeus, 1758) and *Tortrix viridana* (Linnaeus, 1758)] and as a hyperparasitoid of *Glyptapanteles porthertriae* (Muesebeck, 1928), *Apanteles* sp., and *Meteorus pulchicornis* (Wesmael, 1835) (Braconidae) (Zerova *et al.* 1989; Melika 1992), but these data require confirmation.

Distribution. Holarctic.

Key to *Pediobius alcaeus* species group

1. Legs (including coxae) pale, just femora somewhat darker *P. coxalis* Bouček, 1965
- At least coxae and femora dark metallic 2
2. Scutellum smooth medially, with sublateral grooves joining posteriorly to form entire U-shaped groove. Petiole subquadrate, with latitudinal striation (Fig. 1) *P. alcaeus* (Walker, 1839)
- Scutellum evenly alveolate, petiole with longitudinal striation or coriaceous sculpture 3
3. Hind and mid tibiae pale, fore tibia somewhat darker medially. Antennal flagellum of female (Fig. 3) with all segments free, dorsal margin of last flagellar segment somewhat truncate and densely pubescent (Fig. 3) *P. ikedai* sp. n.
- All tibiae darkened. Antennal flagellum of female with last two segments fused (funicle 3-segmented, club 2-segmented, Fig. 13) 4
4. Interscrobal space with sharp projection (Fig. 14). Petiole with one seta on each

side, combined length of marginal vein and parastigma somewhat longer than breadth of fore wing *P. termerus* (Walker, 1839)

– Interscrobal space nearly flattened. Petiole bare. Combined length of marginal vein and parastigma shorter than breadth of fore wing *P. fastigatus* Kamijo, 1983

***Pediobius alcaeus* (Walker, 1839)**
(Fig. 1)

Entedon alcaeus Walker, 1839: 94–95.
Entedon beon Walker, 1839: 107.
Elachestus politus Ratzeburg, 1848: 174.
Pleurotropis polita: Thomson 1878: 254.
Asecodes politus: Schmiedeknecht 1909: 436.
Epipleurotropis longfellowi Girault, 1917: 7.
Pleurotropis politus: Bukowski 1938: 167.
Pediobius alcaeus: Graham 1959: 189; Bouček 1965: 24.

Type material examined. Lectotype ♀ of *Entedon alcaeus*, UK, England, B.M. Type Hym. 5.2376 (BMNH); paralectotypes 3♂, 6♀, similarly labeled (BMNH). Lectotype ♂ of *Entedon beon*, UK, England, B.M. Type Hym. 5.2377 (BMNH). Holotype ♀ of *Epipleurotropis longfellowi*, USA, Pennsylvania, USNM 21400 (USNM).

Other materials examined. 18♀, 3♂, UK, England (BMNH); 1♂, 1♀, Poland, “Las Pivnicki” reserve, ex *Phyllonorycter maestingella* (Müller, 1764) on *Fagus sylvatica* L., 28.II.1985 (Buszko); 2♀, *ibid.*, ex *Ph. coryli* (Nicelli, 1851) on *Corylus avellana* L.; 2♂, Pawlice, ex *Ph. maestingella* on *F. sylvatica*, 3.IV.1985 (Buszko) (BMNH); 2♀, Denmark, Sj. Jungshoved, på lys, 17–19.IX.1965 (Wolff); 2♀, *ibid.*, 2–3.X.1965 (ZMUC); 1♂, Ukraine, Kiev oblast, village Novoselki, 23.VIII.1984, ex *Ph. corylifoliella* (Hübner, 1796), IX.1984 (Sviridov); 1♀, Lvivs’ka oblast, Yavoriv region, Roztochchia Nature Reserve, wet mixed forest, 23.VII.1996 (Gumovsky); 1♀, Zakarpats’ka oblast, Carpathian Biosphere Reserve, 7 km S of Rakhiv, 10.VIII.1989 (Kotenko); 1♀, Russian Far-East, Kamchatka, village Tilitchiki vicinity, 14.IX.1977 (Konovalova) (SIZK); 1♀, Kamchatka Peninsula, between Capes Zhelmy and Ilya, 51°33.50'N, 157°44.19'E, 27.VII.1999 (B. K. Urbain—KM-99-BKU-021); 1♀, *ibid.*, 51°33.54'N, 157°44.34'E, 27.VII.1999 (D. J. Benett—KM-99-DJB-017B); 1♀, Kuril Archipelago, Kunashir Island, Goby Hot Springs environs, 44°00.39'N, 145°41.01'E, 17.VIII.1999 (D. J. Benett—KU-99-DJB-105) (TAMU).

Biology. This species has been reared from a wide range of *Phyllonorycter* species (Gracillariidae) (Noyes 1998).

Distribution. Holarctic: throughout in Europe (Bouček 1965; Bouček and Askew 1968; Hansson 1987; Sviridov 1999), Russian Far-East (Kamchatka; new record), Kuril Archipelago (Kunashir Is.; new record), and North America (Girault 1917; Peck 1985).

***Pediobius coxalis* Bouček, 1965**

Pediobius coxalis Bouček, 1965: 16; Kamijo 1986a: 73, 1986b: 397.

Material examined. 1♀, Russian Far-East, Primorskiy krai, 37 km SEE of

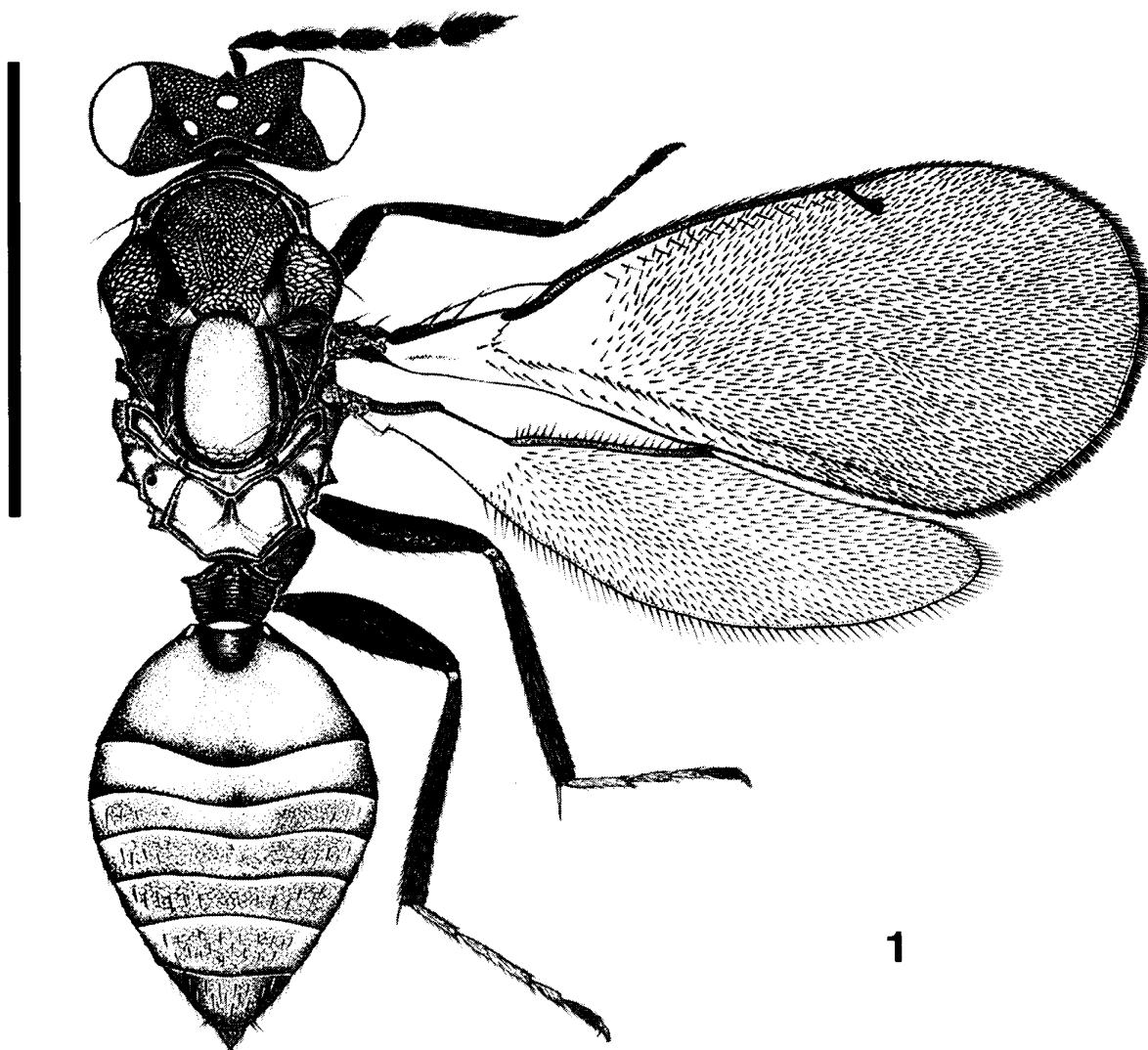


Fig. 1. *Pediobius alcaeus*, female habitus. Scale bar=1 mm.

Tchuguevka, top of stream ("kliutch") Beriozovy, h=1076 m, 25.VII.1975 (Storozheva) (SIZK); 1♀, Kamchatka Peninsula, between Capes Zhelmy and Ilya, 51°33.54'N, 157°44.34'E, 27.VII.1999 (D. J. Benett—KM-99-DJB-017B); 1♀, Kuril Archipelago, Kunashir Island, inland of Alekhina Bay, 43°55.12'N, 145°32.29'E, 19.VIII.1999 (D. J. Benett—KU-99-DJB-111) (TAMU); 2♀, Japan, Hokkaido, Nopporo, Ebetu, Ishikari, 22.VI.1992 (Ikeda) (SIZK).

Biology. Unknown.

Distribution. Czech Republic (Bouček 1965), Japan (Kamijo 1986a, 1986b), Russian Far-East (Primorskiy krai and Kamchatka; new record), Kuril Archipelago (Kunashir Is.; new record).

Pediobius fastigatus Kamijo, 1983

Pediobius fastigatus Kamijo, 1983: 465–467, 1986b: 397.

Type material examined. Paratypes: 1♀, Japan, Muine-dake, Hokkaido, 29.VI.1962 (Kamijo) (BMNH); 1♀, Hokkaido, Bibai, 29.V.1978 (Kamijo); 1♀, Hokkaido, Bibai, 24.VI.1977 (Kamijo); 1♂, *ibid.*, 27.V.1977 (KK).

Other material examined. 1♀, 3♂, Japan, Hokkaido, Jozankei, Sapporo, Ishikari, 15.VI.1992 (Ikeda); 1♂, *ibid.*, Hokkaido University, 19.V.1992; 1♂, *ibid.*, Mt. Moiwa, 20.VI.1992; 1♀, *ibid.* 27.V.1992; 2♂, *ibid.*, 1.VI.1992 (SIZK); 2♀, Kuril Archipelago, Iturup Island, inland of Cape Triokhpaly, 44°28.92'N, 147°00.16'E, 29.VII.1998 (B. K. Urbain—IT-98-BKU-021); 1♀, inland from Sernozavodskaya Bay, 44°58.06'N, 147°53.68'E, 02.VIII.1998 (B. K. Urbain—IT-98-BKU-050); 1♀, Kunashir Island, Goby Hot Springs environs, 44°00.39'N, 145°41.07'E, 17.VIII.1999 (D. J. Bennett—KU-99-DJB-105) (TAMU).

Biology. Unknown.

Distribution. Japan (Kamijo 1983), Kuril Archipelago (Iturup Is. and Kunashir Is.; new record).

***Pediobius ikedai* sp. n.**

(Figs 2, 3, 4–8)

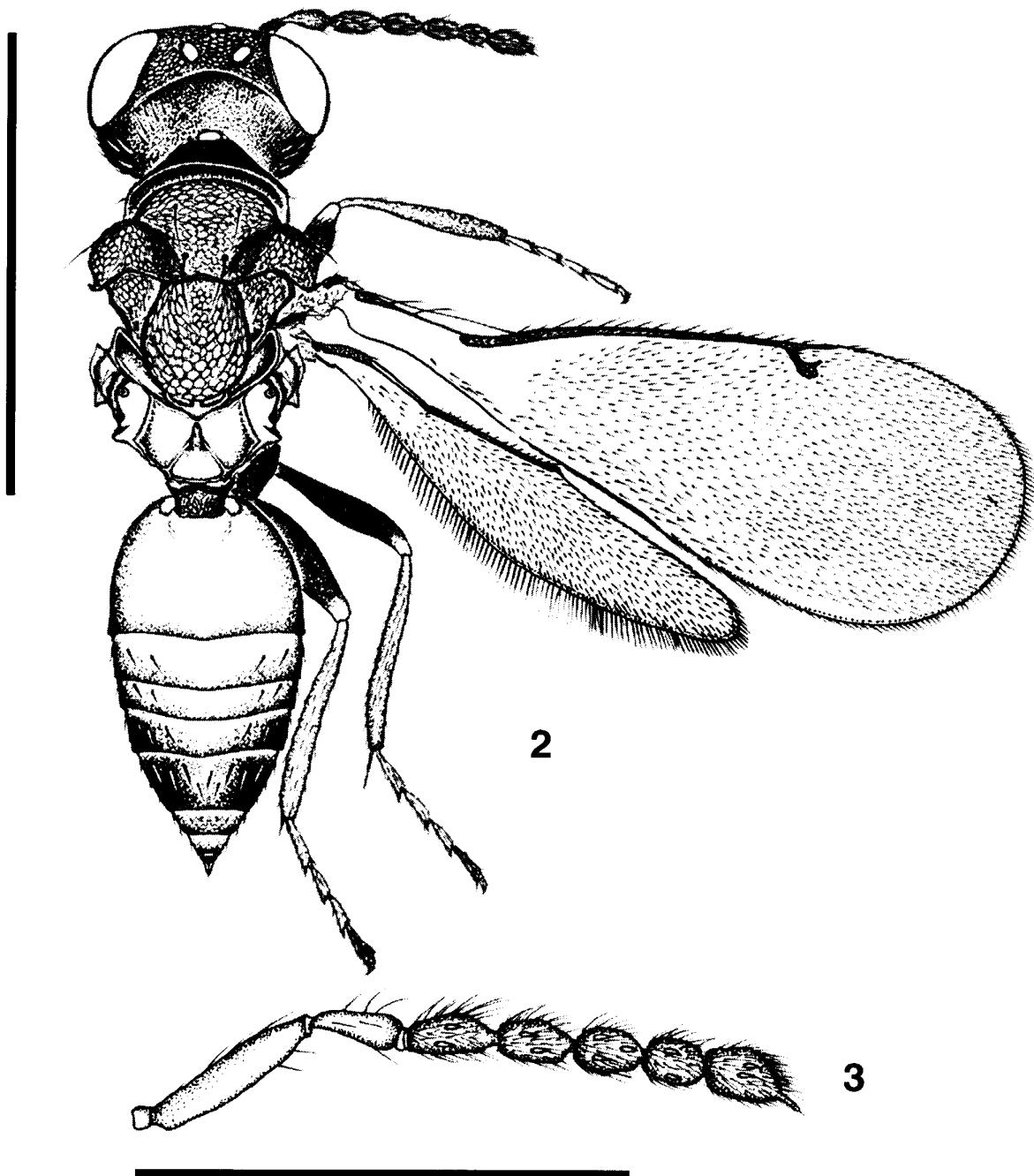
Type material. Holotype: ♀, Japan, Hokkaido, Jozankei, Sapporo, Ishikari, 15.VI.1992 (Ikeda) (BMNH). Paratypes: 3♀, *ibid.*; 1♀, *ibid.*, but Mt. Moiwa, 20.VI.1992 (SIZK).

Description. *Female* (Figs 2, 7). Body length 1.7–1.8 mm. Body dark metallic, with weak green tint, legs darkened, except for pale mid and hind tibiae and their first 3 tarsomeres, fore tibia with paler stripes on dorsal and ventral edges. Wings transparent, venation brown.

Head. About 1.8 times as broad as long in dorsal view. Ocelli large, separated from occipital margin by half of their major diameter; POL twice OOL. Lateral ocellus separated from eye by 3/4 of its own major diameter. Head in frontal view 1.3 times as broad as high. Frontal sulcus complete; eye almost bare, inner orbital margin somewhat curved in frontal view; eye height 4 times as long as malar space. Interscrobal space weakly raised, blunt. Breadth of oral fossa 2.4 times as long as malar space. Antennal scape 4.3 times as long as broad, 3/5 of eye height. Combined length of pedicel and flagellum nearly equal to breadth of head; pedicel 3 times as long as broad, and as long as first funicular segment. Antennal flagellum with 5 separate segments (Fig. 3); first segment twice as long as broad; second 1.66, third 1.5, and fourth 1.33 times as long as broad; last segment drop-shaped, 1.5 times as long as broad, slightly wider than other funicular segments, its dorsal margin somewhat truncate and densely haired, with long terminal spine 0.3 times as long as segment.

Mesosoma (Fig. 6). Length 1.8 times breadth. Pronotum sharply carinate; mesoscutum 1.75 times as broad as long. Scutellum evenly alveolate, somewhat longer than broad and longer than mesoscutum. Axilla with 1 seta. Mesosternum with indicated blunt anterior tooth; this tooth somewhat overlapping prepectus (Fig. 8, mtt). Dorsellum with wide lateral foveae, its lower margin projecting as blunt tooth (Fig. 4, drs). Propodeum with median tooth (Figs 4, 5, pt) continued posteriorly into diverging carinae. Propodeal spiracle on weak elevation, with minute sharp projection below (Fig. 5, spp). Metapleural protrusion acute (Fig. 5, mpl).

Wings. Fore wing 2.4 times as long as broad. Costal cell bare, narrow, 13 times

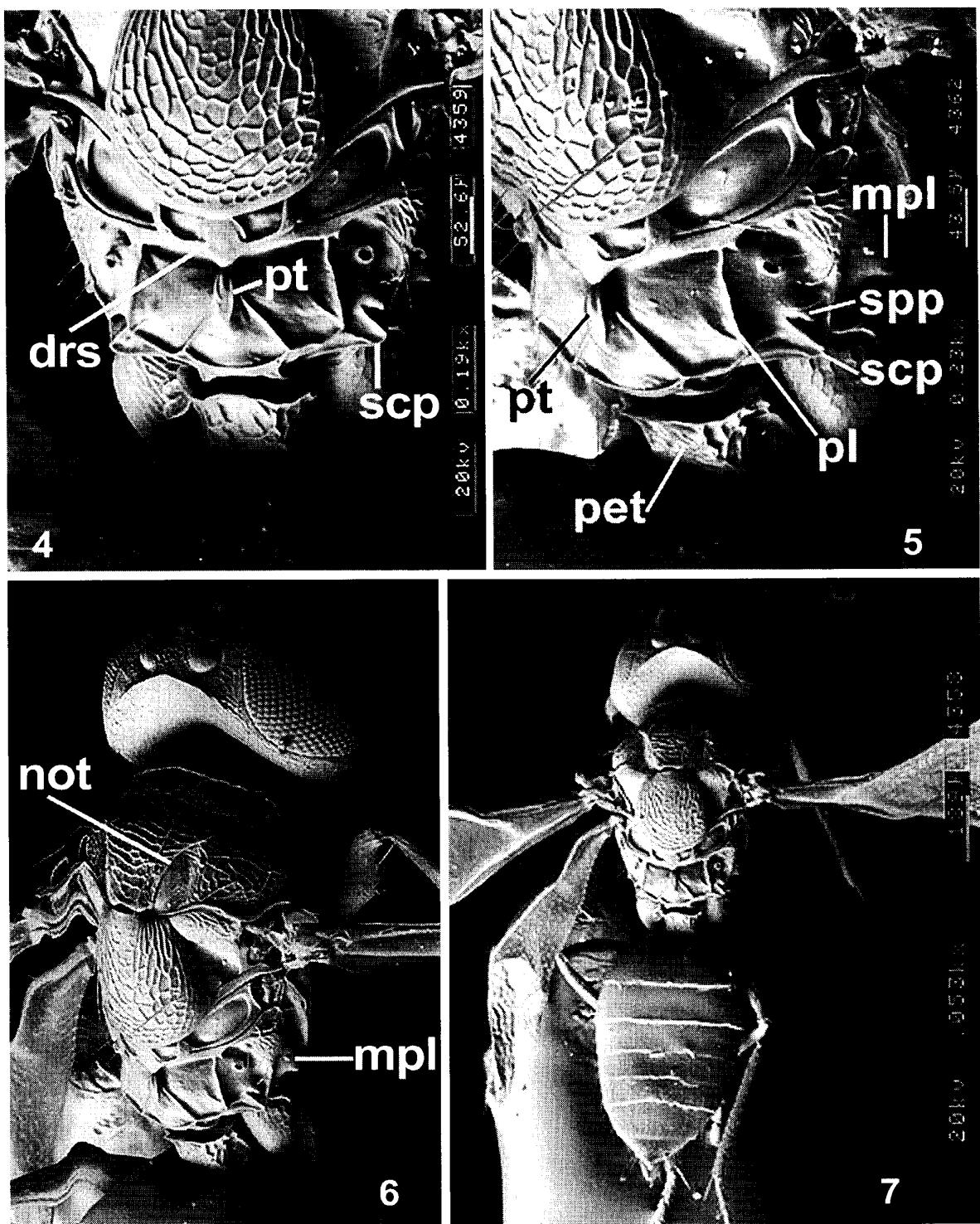


Figs 2-3. *Pediobius ikedai* sp. n., female. 2, habitus; 3, antenna. Scale bars=1 mm for 2, 0.5 mm for 3.

as long as broad, subcosta of submarginal vein with 2 setae on its dorsal surface; marginal vein 2.3 times as long as costal cell, postmarginal vein as long as stigmal, latter comparatively short; speculum closed below.

Metasoma. Metasomal petiole robust, transverse, its surface coriaceous (Fig. 5, pet). Gaster 1.8 times as long as broad.

Male. Unknown.



Figs 4-7. *Pediobius ikedai* sp. n., female. 4 and 5, posterior part of mesosoma and anterior part of metasoma; 6, head, mesosoma, and anterior part of metasoma ($\times 98$); 7, habitus. Abbreviations: mpl, metapleuron; not, notauli; pet, petiole; pl, propodeal plica; pt, propodeal tooth; scp, supracoxal protrusion; spp, spiracular projection.

Biology. Unknown.

Distribution. Japan.

Discussion. This species is similar to *P. termerus* and *P. fastigatus* in having an evenly alveolate scutellum and a coriaceous dorsal surface of the metasomal petiole. The new species is easily distinguishable from both species by the coloration of the hind and mid tibia (pale in *P. ikedai*, entirely darkened in *P. termerus* and *P. fastigatus*), and the structure of the antennal flagellum of the female (all segments free in *P. ikedai*, but two apical segments fused in *P. termerus* and *P. fastigatus*).

Etymology. The species is named in honor of the collector of the type series, Japanese chalcidologist Eiji Ikeda.

***Pediobius termerus* (Walker, 1839)**
(Figs 12–14)

Entedon termerus Walker, 1839: 96.

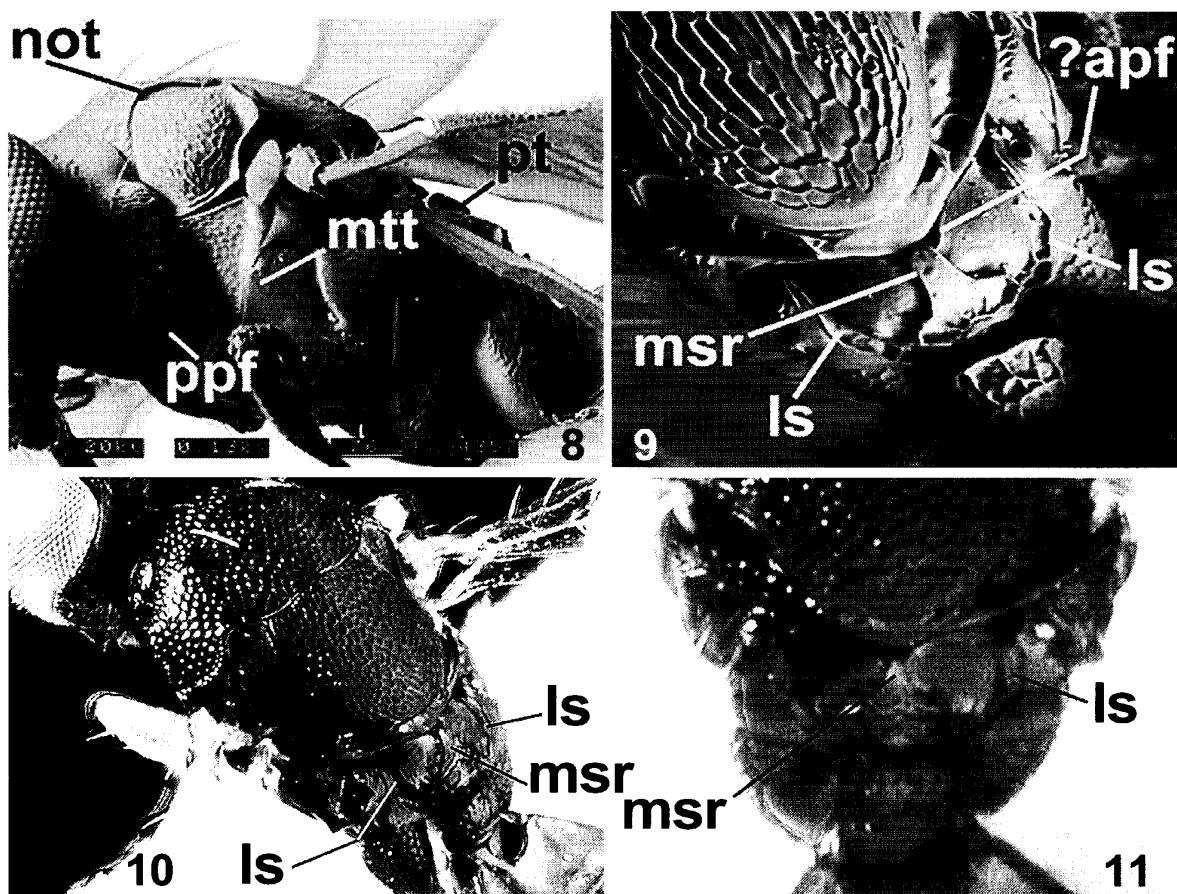
Entedon nephthe Walker, 1839: 107–108.

Horismenus clinus Walker, 1844: 408.

Pediobius termerus: Graham 1959: 190; Bouček 1965: 26.

Type materials examined. Lectotype ♀ of *Entedon termerus*, UK, England, BM No. 5.2384 (BMNH). Lectotype ♀ of *Entedon nephthe*, UK, England, BM No. 5.2385 (BMNH); paralectotypes 3♀, *ibid.* (BMNH). Lectotype ♂ of *Horismenus clinus*, UK, England, BM No. 5.2386 (BMNH).

Other materials. 1♀, UK, England, Southampton, VI.1938, B. M. 1938–190 (Benson); 1♀, North Hants, Spratton district, 30.VI.1975 (Gauld); 1♂, Hants, Romsey, Awbridge, VIII.1980 (Vardy); 1♀, Wales, Cards Llangrannog, 23.VI.1977 (Noyes and Bouček); 1♂, Slovak Republic, Vysoké Tatry, Smokovec, 21.VIII.1958 (Bouček); 1♀, Czech Republic, Bohemia, Krkoneše: Lysečiny, VIII.1964 (Macek) (BMNH); 2♀, 1♂, Ukraine, Zakarpats'ka oblast, Carpathian Biosphere Reserve, Mountain Hoverla, h=2061 m, 08.VIII.1994 (Simutnik); 1♀, *ibid.*, Mountain Pip Ivan, h=1700 m, polonya (i.e., highland meadow), Graminaceae, *Rhododendron* sp., 20.VII.1995 (Senatos); 1♀, Lvivs'ka oblast, Yavoriv region, Roztochchia Nature Reserve, wet mixed forest, 23.VII.1996 (Gumovsky); 14♀, 1♂, Russian Far-East, Primorskiy krai, Sikhote-Alin' Nature Reserve, valley of Kolumbe River, 16.IX.1975 (Storozheva) (SIZK); 2♀, Kuril Archipelago, Urup Island, inland of Barkhatny Bay, 48°48.12'N, 149°54.32'E, 28.VIII.1995 (B. K. Urbain—UR-95-BKU-066); 1♀, 1♂, Chirpoi Island, inland of Peschanaya Bay, 46°32.58'N, 150°54.02'E, 23.VIII.1995 (B. K. Urbain—CH-95-BKU-049A); 1♂, Makanrushi Island, inland of Zakat Bay, 49°44.29'N, 154°25.09'E, 18.VIII.1997 (B. K. Urbain—MK-97-BKU-094); 1♂, *ibid.*, 49°43.93'N, 154°25.15'E, MK-97-BKU-099; 1♂, Shikotan Island, near S side of Del'fin Bay, 43°44.96'N, 146°37.75'E, 15.VIII.1998 (D. J. Bennett—SH-98-DJB-099); 1♂, Shikotan Island, Krabozavodskoe village, 43°50.10'N, 146°45.239E, varia, mostly light trap, 11–18.IX.1997 (Yu. M. Marusik); 1♀, 6♂, Kuril Archipelago, Matua Island, inland of Dvoinaya Bay, 48°04.15'N, 153°15.83'E, 03.VIII.1999 (D. J. Bennett—MA-99-DJB-046); 1♀, 1♂, Simushir Island, inland of Broutona Bay, 47°06.09'N, 152°14.14'E, 08.VIII.1999 (B. K. Urbain—SI-99-BKU-063); 1♀, Keto Island, inland of Diany Bay, 47°18.72'N, 152°26.07'E, 06.VIII.1999 (D. J. Bennett—KE-99-DJB-060) (TAMU); 1♀, Canada,



Figs 8-11. *Pediobius* and *Proacrias* spp. 8, *Pediobius ikedai* sp. n., female, mesosoma; 9, *Proacrias testaceipes*, female, posterior mesosoma and anterior metasoma ($\times 130$); 10 and 11, *Proacrias coffeae*, mesosoma ($\times 60$) and anterior metasoma ($\times 105$), respectively. Abbreviations: ls, lateral propodeal sulcus; msr, median propodeal stripe; mtt, mesosternal projection; not, notauli; ppf, propleural flange; pt, propodeal tooth; ?apf, probable traces of anterior propodeal foveae.

Labrador, Hebron, 13.VIII.1954 (McAlpine) (BMNH).

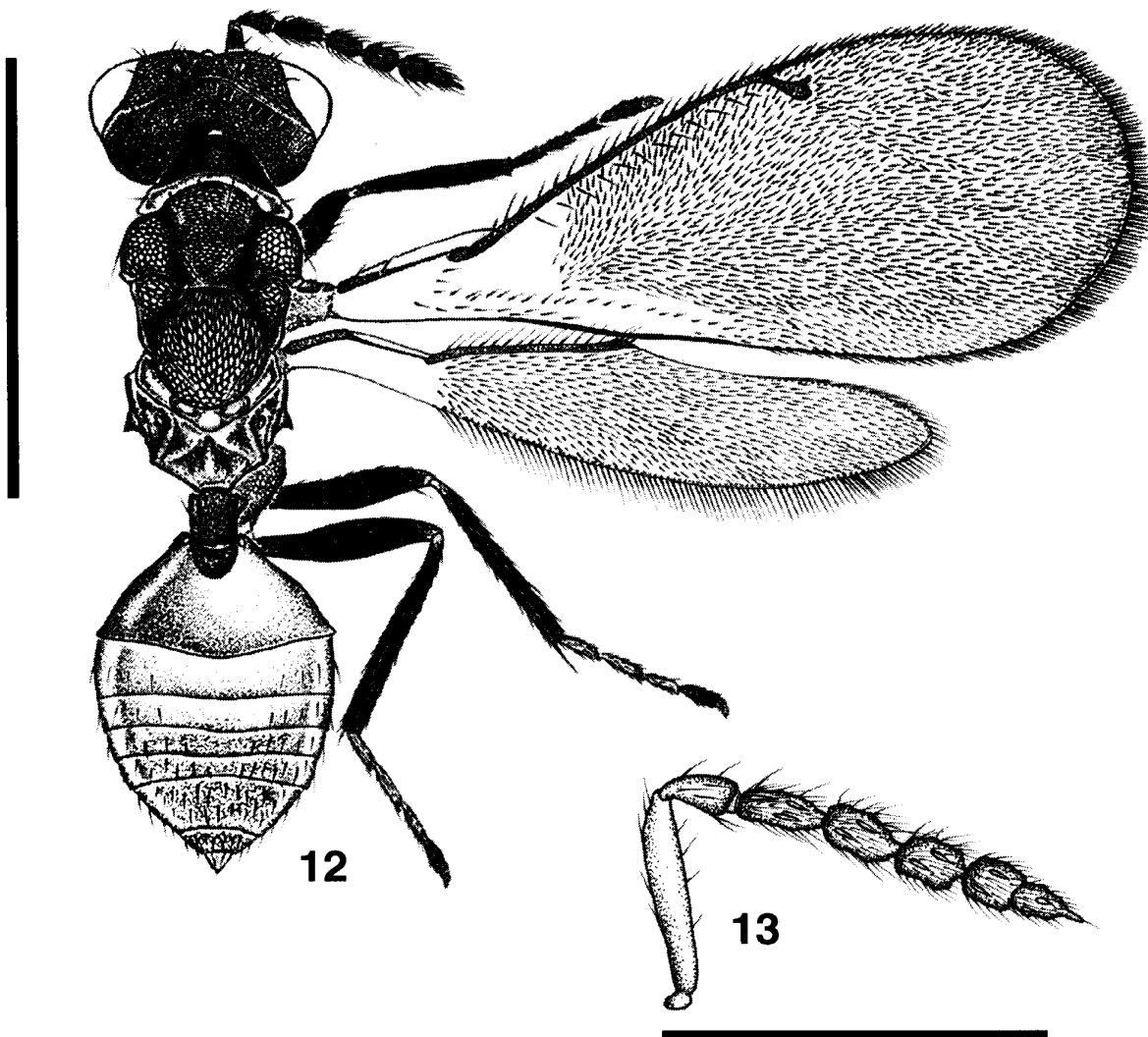
Biology. Unknown.

Distribution. Europe (Bouček 1965), Russian Far-East (Primorskiy krai; new record), Kuril Archipelago (Urup Is., Chirpoi Is., Makanrushi Is., Shikotan Is., Matua Is., Simushir Is., Keto Is.; new record), Japan and Korea (Kamijo 1979), USA, Canada (Peck 1985).

Discussion

Genus *Pediobius*

The main characters that have been used to define *Pediobius* concern the propodeal structure, i.e., the possession of submedian carinae that diverge posteriorly and the presence of distinct lateral plicae (Bouček 1965; Kerrich 1973). Schauff (1991) added a ventrally projecting tooth on the petiole, as diagnostic character to



Figs 12–13. *Pediobius termerus*, female. 12, habitus; 13, antenna. Scale bars=1 mm for 12, 0.5 mm for 13.

Pediobius, but this tooth is not very distinct in some species of the genus.

Gumovsky (2001b) discussed the relationships among the genera allied to *Pediobius* within the “*Pediobius*-complex”. The diagnostic characters of this complex are: a wide and robust propleural flange (bending to the anterior margin of the pronotal panel, Fig. 8, ppf), a sharply toothed metapleural callus (Figs 5, 6, mpl), and a propodeum with two submedian foveae. The generic limits of *Pediobius* and its status within the *Pediobius*-complex remain uncertain. The other genera of the complex (*Pediobomyia* Girault, 1913, *Rhynchetedon* Girault, 1919, *Myrmocata* Bouček, 1972, and *Microdonophagus* Schauff, 1986) have distinct apomorphies, whereas *Pediobius* is largely characterized by their absence (i.e., by plesiomorphies). *Pediobius*, in its current concept, is most likely paraphyletic, if other genera are excluded.

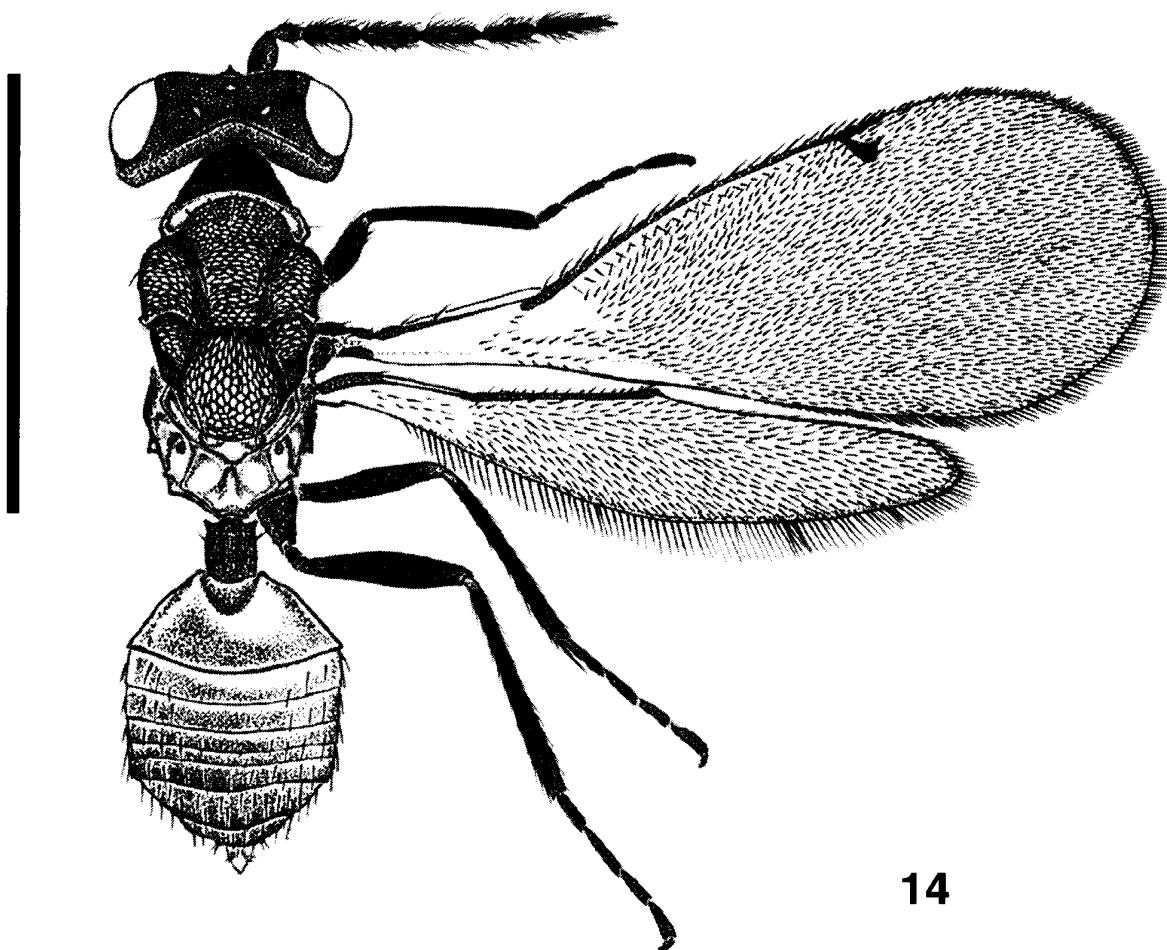


Fig. 14. *Pediobius termerus*, male habitus. Scale bar=1 mm.

The group of *Pediobius alcaeus*

A group of species allied to *P. alcaeus* is an example of a distinctly monophyletic group which has been assigned to *Pediobius* (Bouček 1965; Schauff 1991). The characteristic submedian carinae of the propodeum are replaced by a raised, forward-projecting “tooth” (Figs 4, 5, pt) in *P. alcaeus*, *P. termerus*, *P. coxalis*, *P. fastigatus*, and *P. ikedai*. Bouček (1965) proposed that the “tooth” is formed by fusion of the submedian carinae in their anterior part. Such a proposition is supported by the occasional posterior continuation of the median “tooth” into diverging carinae (Figs 4, 5).

Bouček (1965) mentioned the similarity between *P. alcaeus*, *P. termerus*, and *P. coxalis* but did not formally group them (even though he proposed the first species-group subdivision in *Pediobius* in the same paper). Schauff (1991) discussed the status of species allied to *P. alcaeus* and suggested that they were best placed in *Pediobius*. This decision was largely based on the proposed fusion of the anterior submedian carinae (following Bouček 1965), and also on the possession of other characters peculiar to *Pediobius* (but treated here as those common to the *Pediobius*-complex).

Girault (1917) described a separate genus, *Epipleurotropis*, for a single species,

E. longfellowi. The concept of *Epipleurotropis* was mainly based on the same features as the *P. alcaeus* group described above. Gahan (1921) synonymized *Epipleurotropis longfellowi* with *Pleurotropis alcaeus*, and correspondingly the genera were synonymized. Then Ferrière (1954) synonymized *Pleurotropis* with *Pediobius*, and thereafter *Epipleurotropis* has been regarded as a synonym of *Pediobius* (Bouček 1965, 1988; Schauff 1991; etc.).

Eupleurotropis, Pediobius, and Proacrias

Girault (1917) erected *Eupleurotropis* for *Pleurotropis testaceipes* Crawford, 1914. Then *Eupleurotropis* was synonymized with *Pediobius* by Peck (1963), and *Pl. testaceipes* has been assigned to *Pediobius* ever since. Bouček (1965: 16, 24) associated *P. alcaeus*, *P. termerus*, and *P. coxalis* with *Eupleurotropis*, which, in its turn, was considered to be the same as *Epipleurotropis*: "By the form of the propodeum *P. coxalis* is similar to *termerus* (Walk.) and *alcaeus* (Walk.), i.e., to a species-group considered by Girault a good genus, the *Eupleurotropis* Grlt., with American *P. testaceipes* (Crawf.) as type-species"; "*P. alcaeus* seems to belong to a species-group called *Eupleurotropis* by Girault, in Europe together with two other, also very distinctive species, viz. *termerus* (Walk.) and *coxalis*, n. sp. Also North-American *P. longfellowi* (Grlt.), type species of *Epipleurotropis* Grlt., must be very near to *alcaeus*." These cited remarks demonstrate that Bouček regarded *Eupleurotropis* as the same as *Epipleurotropis*.

However, the structure of the median propodeum of *P. testaceipes* (represented by a wide, delimited median stripe; Fig. 9, msr), is rather different from the typical propodeal pattern of *Pediobius*. Also, the lateral plicae on the propodeum are replaced by complete lateral sulci (Fig. 9, ls) in this species. This propodeal structure is unique within the genus *Pediobius*. The presence of the lateral propodeal sulcus is important for internal subdivision within the genus *Entedon* Dalman, 1820 (Gumovsky 1997). However, in *Paracrias* Ashmead, 1904, there is a gradation in the form of the sulcus (Gumovsky 2001a). The propodeal structure found in *P. testaceipes* strongly resembles that of *Proacrias* Ihering, 1914 (Figs 10, 11).

Proacrias was briefly discussed by Bouček (1977), but he compared this genus with the genus *Chrysocharis* Förster, 1856, not with *Pediobius*. *Proacrias* was characterized by posteriorly diverging submedian carinae and a two-segmented antennal funicle; however, some species of *Pediobius* also have two funicular segments. Apart from *Pediobius*, a variable number of funicular segments is also found in other genera of Entedoninae: e.g., *Paracrias*, *Horismenus* Walker, 1843, *Chrysocharis* Förster, 1856, *Closterocerus* Westwood, 1833, and *Chrysonomyia* Ashmead, 1904, to list some.

I consider the most important characters defining *Proacrias* and distinguishing it from *Pediobius* to be: a median propodeal stripe (diverging submedian carinae in *Pediobius*), the lateral propodeal sulcus (plica in *Pediobius*), a small, barely delimited propleural flange (distinct and clearly margined in *Pediobius*), and small anterior depressions (foveae) at the sides of the median propodeal stripe (Fig. 9, ?apf). These foveae are probably homologous to the anterior propodeal foveae peculiar to the representatives of the *Pediobius* and *Horismenus* generic complexes. Future studies are needed for the clarification of the limits and position of *Pediobius* within the Entedoninae.

Based on the possession of the characters mentioned above for *Proacrias*, I re-

gard *Eupleurotropis* to be a junior synonym of *Proacrias* (not *Pediobius*), and the type species of the former consequently becomes *Proacrias testaceipes* (Crawford, 1914), **comb. n.**

Conclusion

Pediobius, in its current concept, includes rather diverse species, and the monophyly of the genus is not established. There are some distinct species associations (e.g., the *alcaeus* species group) currently recognized in *Pediobius*, that deserve treatment as monophyletic groups. That the *alcaeus* species group is monophyletic is shown by the possession by all its species of a peculiar curved median propodeal tooth, and also the complete notauli with the mesal border raised along its entire length, reduced anterior propodeal foveae, and spiracular elevations with projections beneath. My preliminary analysis of the available molecular data (Gumovsky 2002) suggests that *P. alcaeus* is a sister taxon to some European species of *Pediobius*, but these studies are as yet based on a limited data matrix.

The complete notauli with a margined mesal border and the spiracular elevations with projections beneath are shared by the representatives of the *P. alcaeus* and *P. crassicornis* species groups. However the anterior propodeal foveae are distinctly shaped in the latter group. Also, they are reduced to some extent in some other species outside these two groups [i.e., *P. oophagus* (Dodd, 1917)] that also have the indicated notauli and distinct projections beneath the spiracular elevations. The possession of these characters may suggest possible relationships between these species and the representatives of the *P. alcaeus* group.

As was mentioned above, the anterior propodeal tooth may be just a transformation (anterior fusion) of paired submedian carinae (Bouček 1965). This interpretation is supported by the presence of nearly subparallel, closely joined (nearly fused) and somewhat raised anteriorly, submedian propodeal carinae in some species of *Pediobius* (e.g., *P. regulus* Kamijo, 1986).

Further studies (e.g., rigorous cladistic analysis based on molecular and morphological data) are needed to clarify whether the *alcaeus* group is a derived species assemblage within *Pediobius*, or this species entity is a sister group to other (or most) representatives of this genus. At least the present-day data more strongly support the former proposition. Considering a subgeneric status for this group (by the resurrection of the subgeneric level of *Eupleurotropis*) would either require an arrangement of the remaining species into a paraphyletic subgenus (*Pediobius* s. str.), or it would require a subgeneric status also for other peculiar species groups (e.g., the *P. crassiscapus* group). I defer proposing any such rearrangements until more data become available, and consider species-group status as most appropriate for the assemblage of species allied to *Pediobius alcaeus*, for the time being.

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